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## THE COVER PHOTO

George Kirk, holding the homemade rifle described in RANDOM SHOTS. Note the daylight between barrel and forearm of the rough looking stock.

With Kirk shooting this rifle, assembled from cast-off odds-and-ends, and teamed with C. F. Backstrand, they shot a two-man team Nat'l 50 yard Metallic Sights Record on the Los Angeles Rifle and Revolver Club Range in 1950.

While the photographer evidently overlooked camera viewfinder parallax, he was zeroed in OK on the gun.

## NOTES FROM THE LIBRARY

### Chapter 2

### By Creighton Audette

It seems to be the impression among most bench rest shooters that the accuracy, or rather the superior accuracy of the hollow point bullet is a rather recent development and that it was a discovery or a development of contemporary bench rest shooters, experimenters, and bullet makers, during the past ten or fifteen years.

In the excellent and informative brochure 'Precision Bullet Making Dies' put out by Biehler & Astles the following statement is made: "In the very early days of BR shooting very few of us regarded the hollow point bullet as having any real accuracy potential. While its excellence as a varmint bullet was well appreciated, in comparison with some of the sleeker lead tip and full patch bullets, it just did not 'look' like a target bullet. How wrong we all were! In those days some of the bullet dies available (along with several sets of experimental dies we had made) were capable of making both lead tip and hollow point bullets. As a result, while little was expected, hollow point bullets got tried in BR shooting as well as other types. The results were startling. Given equally well made bullets of all types, it was soon found, and it has again and again been proven and reproven that the hollow point bullet is definitely the most accurate type of bullet existing today."

From my library, it would seem that the discovery of the superior accuracy of the hollow point bullet actually started in 1853, with the development of the Pritchett bullet. This was a hollow base bullet, suggested to Mr. Pritchett by Metford, and was used in the Enfield muzzle loading rifle. In essence, it was the Minie ball, without the plug in the hollow base, since Metford had found that the force of burning black powder effectively expanded the hollow base, without using the tapered plug. Metford subsequently modified this bullet, making it with a hollow nose, which contained an explosive charge, as well as the hollow base which caused it to expand and take the rifling. Metford noticed the superior accuracy of his explosive bullet and made up and tested hollow point bullets of this design, without the explosive charge. To quote from Fremantle's 'The Book Of The Rifle':—"He found that his explosive shell was decidedly more accurate in its flight than the ordinary Enfield bullet, and this led him to adopt for his own use a bullet of similar form, but without the explosive charge. It appears, in fact, that the removal of part of the lead from the centre to the circumference, which was the effect of leaving a hollow in the fore part of the bullet without diminishing the weight, gave greater stability in flight. Mr. Metford having won some important prizes at local meetings in 1862 and 1863, mainly owing to this improved bullet, made the secret of it—if the firing of a bullet exactly similar to the explosive bullet, but without the explosive charge, may be called a secret—public at the beginning of 1864, in connection with the proceedings of the Rifle Conference held in January of that year." The date of the invention of the explosive bullet is given as 1856. The explosive consisted of equal parts of flour of sulpher and chlorate of potash, and was protected by an airtight plug.

Many reasons were advanced for the superior accuracy of the hollow point bullet, including "that it spun on the plug of air in the nose hollow and this stabilized it in flight." The following is quoted from 'Rifles and Ammunition':—"Mr. Metford's engineering and scientific knowledge, together with his practical acquaintance with the rifle, led him to seek in the right place for the reason for this added accuracy, which was that in making a hole in the nose of his bullet to take the bursting charge, without deducting from the normal weight of an Enfield bullet, he had taken the weight from the centre of the projectile and had placed it on the circumference, where it materially aided in the maintaining of a steady rotation."

At one time the British used a hollow point service bullet, the Mark IV. Some authorities state that this bullet gave superior accuracy to the ordinary Mark II form, but:—"With all its advantages, the Mark IV bullet came quickly to an end of its useful life, for in 1899, when the Mark IV cartridge was issued to the competitors at Bisley, it was found that the lead core showed a decided tendency to part company with the envelope, an accident which was exasperating enough when the divorce took place in the air, but which was positively dangerous when the core flew out of the muzzle, leaving the envelope tightly fixed in the rifling, and making an obstruction which, with the next shot, would cause a very serious rise in pressure when the next bullet tried to pass the obstruction." (From 'Rifles and Ammunition'; mention is also made of the effect of the Hague Convention.)

After so much quoting from the writings of our British cousins, let us look at some writings by our own countrymen. From 'The Book Of The Springfield' by Crossman:—"The .280 Ross cartridge, with its steel jacket, 180 grain bullet of very unusual sectional density, and 2700 FPS velocity, swept the boards in the great British long range matches at Bisley and established a new standard of accuracy from 1909 onwards. Not until after the Great War did our Springfield equal the accuracy standards of this rifle and cartridge produced in 1908. The density of this bullet is equal to slightly over 200 grains in the .30 and with its much better point and its 2700 ft., it was a terrific wind-jammer, quite easy to understand. At 1100 yards it shot practically as well as our best modern ammunition turned out 20 years later.

"This bullet, strange to say, had a hollow point, there being at least ¼ inch of the steel jacket unfilled at the point. The base was deeply cupped and the bullet was 'front-closed' to prevent the gas thrust from shoving the core forward and filling up this point as would be likely with an open base ordinary jacket bullet. That is the bullet was filled from the front end and this open end then swaged closed on a 'needle machine.' It was a long way from the present boattail in details, yet both types shoot."

Another quote from the same book:—"Strangely enough hollow point bullets give high accuracy. Twelve years ago Jim Burns told me that their hollow point .22 long rifle bullets, much to their surprise, outshot quite often their 'match' ammunition of this caliber." Since this book was published in 1931 this would make the time of Jim Burns' statement around 1919. Jim Burns was a ballistic engineer who worked for United States Cartridge Co. for most of the first quarter of the 20th century. During this time U. S. C. C. had an enviable reputation as a maker of match ammunition in .30-06, .38 revolver, and .22 short and later .22 long rifle. When the .22 caliber, model 1922 Springfield first came out, it was chambered specifically for ammunition of this make. Burns joined Remington in 1924, and there continued his work on non-corrosive primers, resulting in the Kleanbore line.

With reference to the 'needle machine' mentioned in the next to the last paragraph, I believe this was what is known as a rotary swaging machine. It has two or four dies, mounted in slides in a head and reciprocated radially to swage cylindrical pieces to smaller diameters, or to special configurations, depending on the shape of the dies. I believe it was originally developed for swaging needles and small tubing, such as hyperdermic needles.

And now a quotation from 'The American Rifleman,' April 1949, in an article titled 'Bullet Design' by William E. Davis.

"The stability of a bullet depends upon a number of factors. It is generally agreed that stability varies directly as the square of the axial moment of inertia and inversely as the first power of the transverse moment. Since several other factors (muzzle velocity, twist of rifling, absolute atmospheric density, bullet diameter, and overturning moment) complicate the determination, it is often made empirically by firing through 'yaw cards' at predetermined distances and making computations from data thus obtained. While the private experimenter will not likely attempt any such detailed study of stability, certain general principles are apparent.

"First, in a given weight, any design which tends to concentrate mass near the long axis of the bullet (long points, boattails), thereby increasing the transverse moment of inertia and decreasing the axial moment, tends to decrease stability. Conversely, designs which tend to increase the axial moment without corresponding increase in transverse moment (blunt points, hollow points, hollow bases) tend to increase stability."

I have wondered how it is with the many references to the higher accuracy obtained from hollow point bullets, that this design remained dormant for so long. I have concluded that this may be due to the great interest of our military people in developing the long range boat-tail bullet after World War I and the very high degree of accuracy finally obtained with the improved designs used in the 1924 and later lots of Palma Match and International Match ammunition. This must have led people to conclude that the boat-tail bullet, with long point, was **THE** target bullet, and experimenters continued to work along the lines of this successful design.

Another factor which I believe has a bearing on the greater accuracy of the hollow point bullet is its probable action at its start out of the neck of the case and into the throat of the rifling. It is well known that the base of the bullet tends to start moving ahead of the point, at the instant powder pressure starts to rise. This tends to let the point of the bullet slump to the side, while the base of the bullet tends to expand. (discounting boat-tails.) The hollow point bullet of present bench rest design offers the best structure to resist slumping of the point, since it is light in weight, and broad based. Fill it with the weight of the lead core extending up into the point and the result is to add to the mass and inertia, increasing tendency to slumping. Anyone who has dissected bullets, particularly the .224" small exposed lead tip type used in the early days of bench rest shooting, has observed the rather uneven 'fluting' of the inside of the bullet jacket at the ogive. This must also indicate uneven distribution of the lead inside the point and uneven distribution of the strains in the lead and jacket, both increasing the tendency to slumping. From this viewpoint, the use of the 'needle machine' to swage the points closed might be an advantage.

Years ago when I got my first loading set for the .30-06 and molds for the Pope and Squibb bullets I had a lot more time than money and spent a lot of time experimenting with cast lead bullets. I had a range in the old farm house where I could shoot out of the attic at distances up to 200 yards and I did a lot of testing, shooting through targets into the snow and recovering the fired bullets. Just a bit too heavy a charge behind the Squibb bullet would cause the point to slump and accuracy would go to pot. Sometimes with a borderline load some of the points would slump and some would not. Location of bullets as they were recovered showed that the fliers were generally those bullets whose points had slumped. The hollow point Squibb would stand more velocity than the regular Squibb. I later took a Squibb bullet mold and recut it to eliminate the so-called dirt catcher groove at the junction of ogive and body. These shot more accurately than the regular bullet and would stand higher velocity before losing accuracy. I believe the 'dirt-catcher' groove weakens the point of the bullet and increases the tendency towards slumping.

Chapter Two took up more space than I intended, so the story of Winchester's **'new'** shotgun shell will have to wait for chapter three. If room permits, chapter three will also include a few notes on a book published in 1864 which clearly shows the spiral flight of an unbalanced bullet and the Woolwich Arsenal tests in 1912 of the effect of eccentricity of the bullet jacket. Bullets were manufactured with eccentric jackets and then these were fired from machine rest at 600 yards, half of the bullets positioned with high point of eccentricity up and half down. The result? Two rather normal size groups with points of impact about 18 inches apart, horizontally.

I understand from our editor that one intrepid soul sent in an extension of his subscription after reading chapter one of this narrative. Chapter three waits on the same offer. Do I hear a volunteer?

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## HOW GOOD IS OUR BALLISTICS KNOW-HOW?

Mr. Creighton Audette's "Notes From The Library" in the November issue of this magazine was both interesting and instructive. He draws our attention to something about our ballistics know-how that should be discussed at length.

But first let me discuss his inquiry regarding my August article "Concerning The .45 Auto Cartridge." In that article, I stated that the velocity of a bullet fired from a .45 Auto Pistol was less than that fired from a fixed barrel weapon even though the test cartridges were as nearly identical as it was possible to make them and the fixed barrel was the same length as the pistol barrel. This wording is not identical to that used in my article but the meaning is the same.

When Twin Cities Arsenal first started production of the .45 caliber auto cartridge and our ballistics department received its first lot for test, the test was processed strictly in accordance with the requirements laid down by Ordnance. However, when the resulting figures reached my desk, I was certain something was wrong because I, too, was familiar with past statements by the authorities quoted by Mr. Audette. More ammunition was obtained and I personally followed through on each individual phase of the overall test. The new results were identical with the first, Then, to make the cheese more binding, I processed additional velocities from five additional pistols and five additional fixed barrel guns. The fixed guns were simply Springfield actions to which were fitted rather heavy five inch barrels. I don't remember the precise results but I do know that the various combinations of pistol vs fixed gun produced differences of 60 to 90 foot seconds in velocity. I started to find out "why" but Ordnance stopped me in my tracks with the statement that it was my job to test ammunition and not to solve basic questions in ballistics.

All Ordnance velocity tests, regardless of caliber, always comprised 20 shots. The same was true of pressure. Accuracy tests consisted of nine 10-shot groups. Why it should be the odd figure of nine, only the Army can explain. Accuracy tests were fired from a fixed barrel weapon similar to that described above and since accuracy could be fired through velocity screens, I made it a point to insist that this be done. During a period of two years, some 2000 lots were processed. Each test included one 20-shot string for velocity, one 20-shot string for pressure, and nine 10-shot strings for accuracy. Weapons had a habit of wearing out and required frequent replacement. But always the result was the same. The auto pistol always produced lower velocities of from 60 to 90 foot seconds or an average of about 75 fps. Now, a loss of 75 fps is a lot of velocity to make up when we are trying to move a 230 grain bullet at 810 fps. Because of this loss, it was necessary for the contractor that ran the production system (in this case, Federal Cartridge Co.) to request an increase of 3000 psi in the specified pressure allowance. I was present at the committee meeting at Frankford Arsenal when the contractor made that request and when it was agreed to and allowed by Ordnance. This increase would never have been allowed had Frankford not been aware of the velocity differential between the pistol and the fixed barrel. Also let it be known, the pistol was never designed to take the pressures and velocities it is now subject to.

This loss of velocity in an automatic weapon also occurred in all models of the Browning Machine Gun. Of course, the Browning barrel recoils a short distance and this probably accounts for some of the loss. But what really surprised us was the variance in velocity between individual shots. A 20-shot velocity test in a fixed barrel weapon that produced an extreme variance of only 20 fps would produce 200 fps variance in the machine gun. Of course, mechanical tolerances are always greater in a machine gun just as they are in a pistol and this could be where much of the problem lay.

But now let us return to the original sources quoted by Mr. Audette. I believe that if Mr. Quayle of the Bureau of Standards had had the curiosity to run a simultaneous fixed barrel velocity test, his excellent analysis of what he **thought** he saw in his spark photographs would have been supported by a much more solid foundation. As to Mr. Johnson's book, I would go one step further. If Mr. Johnson had had the curiosity to make simultaneous fixed barrel tests of **both velocity and accuracy,** his conclusions would have been quite different than those stated in his book.

And to go all the way back to my title, I would like to say that Mr. Audette's inquiry has opened up a Pandora's Box of ballistic ills. If the editor is agreeable, I can perhaps explore some of the reasons for this situation in the next issue of Precision Shooting.

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## BROOKLYN, NEW YORK

Roy Oster beat the field of 64 competitors in the Metropolitan Rifle League "Double Individual Match," December 16th. The Double Individual was two 40-shot matches at 100 yards, indoors with scope sights. Roy won the first match with a 400-36x, the second match with 400-37x and his double-aggregate of 800-73x is a new record on the Metropolitan Rifle League reduced target, which has a 1¾ inch 10-ring and ⅞ inch X-ring.

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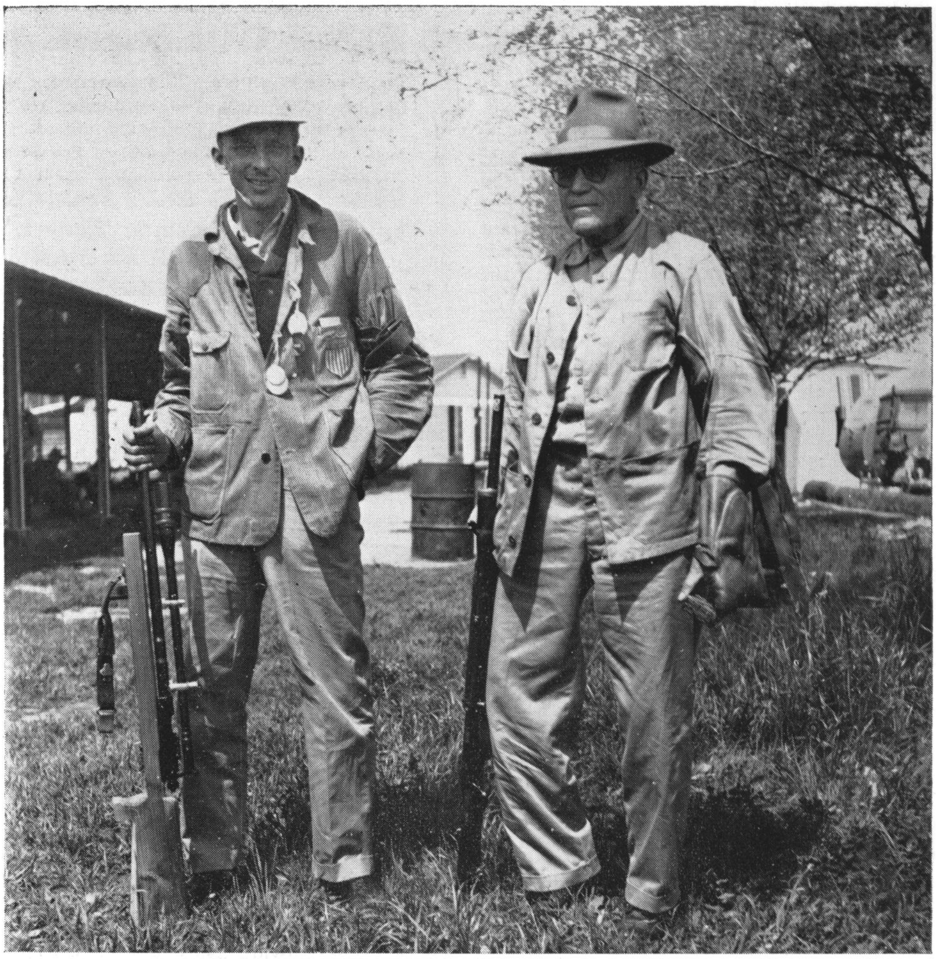
# Random Shots

### By Betty Summerall Duncan



George Kirk and C. F. Backstrand, who established a Nat'l 50-yd. Metallic Sights Record in 1950. Rifles shown with scopes, although record was with irons.

Much emphasis has been placed on fine rifles, tuned to perfection, for achieving maximum accuracy. So, it's news when we hear that a barrel salvaged from a trash can established a Nat'l Record!

This bit of shooting lore features George Kirk, creator of the contraption in the photo, and Clarence F. Backstrand, one of the most beloved gentlemen who ever stepped foot on a firing line—doing so for the first time in 1902.

About thirteen years ago Kirk took a Fordson axle, and from it fashioned an action and trigger. He decided that he didn't want to pay for a good barrel until he knew what he had made was satisfactory. He obtained permission from Roy Gradle, well-known gunsmith from Santa Barbara, to pick out a barrel from the trash where it had been out in the weather for 1½ years.

Kirk further decided that he didn't want to put on a good stock until he could ascertain how his homemade equipment would perform. He, therefore, took a piece of weather-beaten 2′ X 4′, on which he used a saw and hand axe, assembling the equipment as you see it in the photo. He fastened the receiver with two bolts through the stock. You will note that the barrel sits above the top of the stock, which is easily discernible in the picture. (No need for a bedder here!) Pipe wrench marks can be detected near the muzzle and vise marks are visible back near the receiver. The hand stop was whittled off round and fastened to the stock with a nail.

This unorthodox assembly made its debut at the Los Angeles Rifle and Revolver Club at the Pacific Coast Championship in April 1950. As the 2-man team match was about to be fired, Clarence was relaxing under a tree, not planning to enter. He heard someone call, "Where is Backstrand?" It was Kirk, looking for a team partner. Clarence protested, "You can find somebody else who will give you a better chance." But, the next thing he knew, George came with their squadding ticket and said, "We're going to shoot."

Kirk was already set up on his position when Clarence got his equipment on the line, making his way through the crowd which had gathered in disbelief. Kirk's outfit had become the object of much laughter and ridicule . . . George took Clarence off to one side and said, "Don't let the looks of that gun bother you," and showed him a group fired with it which Clarence found astounding.

Backstrand recalls, "Never once while I was coaching did I tell him where to hold, but I did keep up continuous conversation about what I thought the conditions were. I did spot the shots for him, and Mr. Kirk told me that he never used his spotting scope."

The conclusion of the match definitely stamped out the laughter, for this amazing phenomenon had produced a 400. Clarence lost a point, but their 799-60X established a 50-yd. metallic National Record!

That is the last we've heard of George Kirk and his accurate, homespun rifle (which defied all theories of rifle building), although I have a vague recollection of hearing his name in connection with shooting in Pennsylvania. I wonder if any of you can tell us what has happened to him.

Clarence Backstrand still makes frequent appearances at tournaments, driving from Riverside, Calif. in one of the fastest Corvettes on the road (it factory tested at 140 m. p. h.). He would still be a competitor if he were not so badly crippled by arthritis that he is unable to get into position.

His love for shooting dates back to the early 1890s when his uncle took him squirrel hunting in the big maple woods of Penn. He was taught to always keep his rifle unloaded when walking through the woods, climbing fences, or riding in the buggy. If young Clarence became careless about firearms safety, his uncle punished him by making him stay with the horse and buggy instead of hunting. Clarence thought him the meanest man in the world, but now realizes that it was the best possible training for a youngster.

This venerable "old-timer" began shooting smallbore in 1902, but then eased off for 15 years. In the meantime he was concentrating on military big bore, and qualified for Distinguished Marksman in 1904, 1905, and 1906. Also in 1906 he was awarded a gold bar for being a member of the Calif. State High Power Team which fired at Camp Perry . . . When he settled down to shooting smallbore in earnest, he was a real threat and won his share of aggregates. He was no longer a youngster with "hawk eyes" in 1951 when I remember his winning the Metallic Agg. at a large tournament in Phoenix . . . Clarence has merely mellowed with the passing years, and his gracious manner and sense of humor are unsurpassed.

* * * * *

A word of caution to all competitive shooters—: do double check your gear before departing from a tournament! We were shocked to learn that articles left behind—such as mats, gloves, coats, slings, scopes, and even a movie camera—were auctioned off at one range. Some items were recovered when one person made a trip back there and demanded the return of specified articles belonging to several shooters. We understand that the mandate was issued by one with political power, however, and not directly affiliated with shooting activities.

* * * * *

Glenn Taylor reports that George Stidworthy took the monthly Phoenix Rod and Gun Club aggregate on December 9th with 1599-124X. Conditions generally were good, but that desert wind threw a tantrum for a few minutes and during that time George dropped a point at 100 yds. with scope. The course of fire was 50 yds. and the Dewar, metallic, and the Dewar and 100 yds. any . . . It looks as though George is really working at getting out of the runner-up category.

* * * * *

It was with interest that we read the article in the autumn issue of **The Rifleman** of Great Britain entitled "British National Targets Used in the U. S. A." The inspiration for and included as a major portion of the article was the letter written by Pacific States Fall Round-Up Champ Tom Guerin to his old friends in England, discussing the Calif. State matches when the British Nat'l target was used for the first time in a tournament in this country.

Guerin remarked: "The general reaction to the new target was favourable," but "the most common complaint was that the lines separating the scoring rings were too faint for 'any sights' shooting," and 'in a heavy mirage, it is almost impossible to determine your hold point, even with a 20 power telescope."

We have heard no objection to the target for metallic sight shooting, as the larger bulls, reminiscent of the old 50-meter target, are conducive to more accurate "holding off." It is merely a matter of experimenting to select the proper sized aperture. There are those, however, and very fine shooters, who maintain that trying to hold closer than they are capable of doing on this target with scope has resulted in habitual jerking on our standard targets.

We decided to get the opinion of former Nat'l Champ Vic Auer who, although he did not fire in the Calif. State matches, has had experience shooting on the I. S. U. targets. Vic contends: (1) "The British National target has one undebatable advantage—the encouragement of perfectability in shooting. Perfection is an ideal, never realized; "perfectability" is a process by which it may be better approached. Being able to shoot a little more perfect—which shooting the British Nat'l target encourages—can be analyzed on all levels. I will limit myself to a succinct analysis of trigger squeezing.

(2) "A smaller bull requires concentration on all aspects of shooting technique, squeezing technique being only one important aspect. The tendency to jerk under pressure should be measured in practice by shooting on a smaller-ringed target. The more a shooter aims for X's, making each round well spent, the more he learns that improvement in wind-shooting and in shooting against one's self is to be gained by testing himself on a smaller-ringed, more challenging target.

(3) "To digress, many shooters have rejected a desire to shoot the I. S. U. target because they believe the closer concentration has climaxed trigger jerking. This is absurd. If a man finds himself jerking after shooting a smaller-ringed target, he probably was jerking prior to that experience, or had the tendency to jerk under tighter pressure.

(4) "Gentle squeezing is a fallacy; all quick accuracy is achieved in snap-squeezing. If one squeezes too slowly he allows too much time for wind change, he uses unnecessary energy in concentration, taxes his breathing control, and builds up pulse. Also he will, possibly, build up a tendency to jerk. Every shooter who aspires to win should learn to tighten his groups by getting more rounds off quickly, in wind, at a lesser expense of energy, by 'snap squeezing'."

On one occasion we had an opportunity to observe the firing line from an elevated spot when Vic (who shoots a high position) was firing near another top-notch shooter. Vic's barrel was steady as a rock following each let-off, but, in comparison, the other shooter's barrel was afflicted with St. Vitus dance.

I'm sure that many of you will profit by Vic's advice, and I believe that he may have erased some doubts about shooting scope on these new targets. Take our 50-meter target, for example. It necessitates a tighter hold and, after one overcomes a sub-conscious fear of the target, better groups with more Xs than at 50 yds. frequently result . . . Closely related to this same subject, one shooter employs a trick of dry-firing a couple of rounds or so before even starting on his sighter. Try it some time, even in the middle of a match, if you are feeling a little buck feverish. You will see how well you really can hold, which helps a great deal toward restoring any shattered self-confidence.

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Another article in the English Smallbore Rifle Assoc. journal, **The Rifleman,** with which we were extremely impressed was on the matter of Press Coverage and states as follows: "From Headquarters we issued the usual 'handout' a few days before the Meeting" (referring to the Bisley matches) "to some 250 daily, evening and national weekly papers. This whets the appetites of editors—we hope—and as reference is made therein to the attendance throughout the Meeting of the Press Assoc. representatives, a direct tie-up within the framework of journalism is created . . . The Press Assoc. wired no fewer than 13,368 words from Bisley Camp about small-bore shooting results to daily and evening newspapers. In addition a dozen weekly papers commissioned P. A. to supply a summarized local successes story . . . Add to this the excellent coverage of the **Daily Telegraph** and two or three reports in **The Times** and we can be well pleased . . . Independent Television News cameras were on the range on Sunday and film was televised during the I. T. N. newscasts later that evening."

The only press coverage which I was ever able to dig up on our Nat'l Matches was in the small Port Clinton, Ohio paper—although a tiddly-winks tournament did make the front page of one sports section during the period when our championships were being fired. And, consider that the above amount of publicity is possible in a nation where firearms restrictions are stringent . . . (I did hear some time afterward that the Cleveland, Toledo, and D. C. papers made some mention of the Perry winners).

Forgive me if I haven't simmered down yet after reading the big splash afforded the top champions of practically all sports, except shooting, in a local newspaper after they were honored at a banquet at the Beverly Hilton. Incidentally, they were selected on a nationwide basis and brought to Los Angeles for the festivities. There were even aquatics champions as well as one for auto racing. This incident only adds fuel to my irritation that this capitalistic nation has become so materialistic that unless a sport means dollars in someone's pocket, it isn't worthy of consideration. It grieves me to think that we have a World Champion who has gone unrecognized simply because the spirit of the first Olympic Games has become lost to those who control the sports dynasty. And, they wonder why they weren't awarded the bid for the 1968 Olympics and are upset that so much money slipped through their fingers!

* * * * *

Congratulations to T/Sgt. Edward E. Caygie, Jr., USAF, on tying Candy Jensen's U. S. English Match Record with 598X600 prone on the ISU 50-meter target with metallic sights at the Fall Int'l Matches at Lackland AFB, Texas on Dec. 8-9! Ed was shooting his Atkinson-Marquart BSA Mark II with Redfield Mark VIII rear and Freeland front with .140" green aperture (note the difference between this and his usual .120" for standard targets) with clear glasses and a blue filter in his iris disc.

This was an interesting shoot because most of the shooters who will be competing in the U. S. Pan-American team tryouts, beginning January 21st at Lackland, were there competing on the ranges where the tryouts will be held . . . The USAF Int'l pistol shooters won nearly all of the pistol matches, which were fired Dec. 1-2.

The USAF Int'l Smallbore Team also won the English Match with 2368. Team members were Caygle—598; Capt. John T. Bertva—592, firing a Hart-BSA Mark II with Redfield Int. rear, Freeland front with

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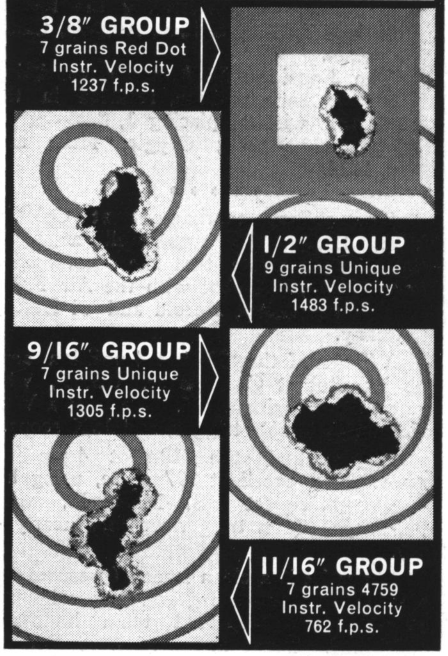

Why let your 30-06 hibernate this winter when you can use it to shoot gallery groups like these. Keep your shooting eye sharp—and have fun doing it! Gallery shooting with Hornady S-Js is inexpensive fun, too. Our 100 grain S-Js are only $2.85 per hundred (your wallet will like that!).

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### Random Shots

(Continued from Page Five)

.140″ aperture; S/Sgt. Allan H. Hannon—589, who used a 40-X, same sights as the others with .145″ front aperture; and Lt. Robert C. Metsker—589, shooting a Rem. 40-X with custom stock and bedding by S/Sgt. Stout, with sights already mentioned and .145″ front aperture. They all used the 3-lb. NRA trigger as those are also their NRA prone rifles and they see no advantage in changing triggers back and forth after they have the guns shooting and are accustomed to them.

Winner of the free rifle grand aggregate was M/Sgt. William E. Krilling, U. S. Army Int'l Rifle Team, and a member of the 1962 Int'l Dewar Team with 1726X1800. He used a Remington free rifle with Redfield Int. sights . . . Caygle was second with a 1724 score, firing a Hart 40-X with trigger by USAF Mks. School, in a stock of his own specification and design made by S/Sgt. Stout . . . Sgt. David Boyd, USMC, placed third,—1715—shooting an Anschutz with factory trigger and sights.

Boyd was high in the 20-shot 3-position ISU match with 571X600. High Junior was Robert Perkins, son of the Lackland AFB X0, who fired a new National Junior Record—535—bettering the former record, held by Ken Golden, Arcadia, Calif., by 9 points.

The 3-position ISU match, consisting of 40 shots each position, resulted in the Grand Agg. winners placing 1, 2, 3—Krilling with 1133X1200; Caygle, 1126; and Boyd, 1124.

* * * * *

The gallery tournament at Colonie, N. Y., Dec. 14-16, was well attended. Ruth Morgan wrote that she accompanied her son, Bob, and shot with the Air Force boys. They visited Harold and Vi LeRoy in Albany.

Winner of the 20-shot 4-position agg. was Lt. Robert C. Metsker, USAF, who came through with a 791. He used a Womack-52-C, Canjar trigger, and 15X scope.

Caygle took the 10-shot 4-position agg. with an excellent 397 score, using his Atkinson-Marquart BSA-Mark II, with 30X scope. (His trigger weighed nearly 4 lbs.).

To make it a clean sweep (presumably, as we don't have the grand agg. winner), the Air Force captured team honors—**1570X1600.** Team members were Bertva, firing a Hart-40X in a free rifle stock with 40X trigger, 30X scope; Metsker, Caygle, and S/Sgt. Franklin J. Tossas, whose equipment was identical to Bertva's.

* * * * *

Henry Wright was most cooperative in scheduling his International Smallbore and Big Bore Matches for Feb. 22, 23, and 24 in Fresno, Calif. This will enable the Int'l shooters to fire the Western Wildcat tournament immediately following, before continuing on their tour to the Sawgrass and Silver Dollar tournaments in Fla.

* * * * *

The newest item of shooting equipment we've seen is the no-slip sling-cuff designed by Leland Auer, which began appearing on West Coast ranges just before Christmas. It comes in either plain, tooled leather, or tooled with a short name or initials. Vic has used this since he began shooting, but the sling-cuff was improved five times before it was put on the market.

* * * * *

A letter from A. O. Tshirner, Santa Cruz, Calif., states that if the Russian shooters hadn't received the "show dog" treatment starting several months before take-off, they would have had no better luck than we did in Cairo. He mentions a semi-starvation and cleanout treatment which, followed by more ("odd ball for us") dieting will prevent almost anything for awhile . . . Note: added to this, they did have their own food in Cairo!

* * * * *

The atmosphere is fairly bristling with repercussions from the finality of the decision on the mandatory 3-lb. trigger rule, which has been included in the 1963 Smallbore Rifle Rule Book. This is an explosive issue, and one which will not be mediated quickly. We invite arguments on both sides, and will continue to devote space to the subject as long as it is a matter of concern to a large number of shooters.

A preliminary analysis of the issue requires an essentially logical approach with consideration to a number of viewpoints. Let us begin with the NRA's reasoning that rules should be enforced. We can't argue against that because we agree that certain rules are necessary. Also, if all rules are not rigidly enforced, then laxity may be permitted in the enforcement of rules which we consider desirable. (For example: the prone position rule is not rigidly enforced, although my mention of this is not the way for me to remain on the best of terms with some of my good friends—and may be termed "fearless journalism").

Next, let us consider the matter from a strictly prone aspect. I doubt that many prone shooters are disturbed over being required to shoot a 3-lb. trigger, as long as everyone will be using a minimum 3-lb. pull. Personally, my trigger has always lifted a 3-lb. weight, because I believe in adherence to rules (although I might add that it is more of a hardship to me than to most, for, having been stabbed in the right "forearm," my trigger coordination is very shaky toward the end of a tournament).

The phase of the issue which is of major importance to those prone shooters who have given it much thought is the manner in which the rule will be enforced. Further, as someone has said, some of our "law-makers" never step foot on a firing line except to have their pictures taken. They, perhaps, have not considered that a trigger, being a mechanism, is not infallible and may change at any time. Disqualification is too stiff a penalty when a shooter starts out with a 3-lb. pull and, through circumstances beyond his control, his trigger slips below the legal weight. We feel that disqualification should be limited to instances where there is an **intent** to cheat. A rise in temperature or blowing dust can lighten a trigger, or it may change for no apparent reason. Admittedly, its weight cannot be construed to remain perfectly constant.

In order for rule 9.14 to be effectively applied to prone shooting, some amendments must be added to it fully defining the manner in which it will be enforced. **First,** it should be stated that a Referee will not hold up the line for the purpose of weighing triggers. There is ample time to accomplish this without interfering with scheduled firing. In a large tournament, there are seldom enough hours of good daylight to run two relays and a team match if there is any unnecessary delay. Further, it is unfair to competitors to be deprived of early morning calm conditions if triggers are weighed at that time as they were on one occasion. . . . **Second,** it must be specified that once it has been determined that a certain trigger will lift a 3-lb. weight, a competitor cannot later be disqualified should his trigger slip below the legal weight. . . . We believe that the majority of shooters are basically honest and would not tamper with their triggers after they were weighed. To cover that eventuality, however, a **third** amendment would read: any competitor found to have lightened his trigger below the 3-lbs. will be disqualified.

The major opposition, quite understandably, is from the angle of the position shooter. Thus far, we have managed a logical approach rather successfully, we think. But, the more we analyze the problem, the more elusive a logical explanation becomes. It reminds me of an editorial which I've just read, deploring the absence of the syllogism from current national and international policy. I became rather familiar with logic and the syllogism in college debating. (If I've lost any of you, refer to your dictionary—it is a healthy habit). To continue, I fear that the syllogism has been "misplaced" in regard to consideration of the enforcement of a 3-lb. trigger for position shooting.

It is my understanding that the NRA's stand is based on the laudable desire to insure the use of safe triggers. We are all concerned with firearms safety. But, what constitutes a "safe" trigger? If it is safe for a shooter to use a **2-ounce** set trigger in an ISU match during the morning at Perry, why isn't it safe for him to use a **2-pound** one in the NRA 4-position match on the same range in the afternoon? Further pursuing logic and searching for the syllogism, we find that the Pistol Rule Book provides for a minimum weight of **2½ pounds** for the service revolver (caliber .45), and centerfire pistols or revolvers of .32 caliber or larger (including .45 caliber pistols and revolvers). A **2-pound** pull is allowed for .22 caliber pistols and revolvers! . . . So, again we ask a calculated question—: What does constitute a safe trigger? There are those who contend that pistol shooting is more dangerous than position rifle shooting. In view of that comparison, who can explain to the position shooters why a 2-lb. trigger is safe for .22 pistol and not safe for .22 rifle when fired either in a gallery or outdoors, particularly as most rifles are fired single-shot while pistols are multiple-loaded? . . . The smallbore prone position is the least dangerous of all—so, . . . confusing, isn't it? And, where, oh where is our logic?

One further remark on this weighty subject of trigger weights will suffice for now—: as I interjected last month, it seems highly advisable that there be a separate and distinct rule for juniors, and possibly for newer shooters below the classification of Expert. Whatever the eventual outcome of the rule, new shooters might best be taught to handle a 3-lb. trigger.

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### Brooklyn, New York

(Continued from Page Three)

Following Oster with "possibles" in the aggregate were: F. Boyd 800-64, F. Addeo 800-63, Rans Triggs 800-63, L. Grossco 800-61, H. Swarts 800-60 and E. Hager 800-49.

Ten shot possible 400 scores in the first match and eleven made 400's in the second match. In the second match, Sam Burkhalter dropped a point but tied Oster on X's—37 of them. Sam also dropped a point in the first match but had 34 X's.

# ON THE MEASUREMENT OF LIGHT ABERRATION

**By Jesse M. Grigg**

It is well known that a condition of mirage or light aberration may cause a shot to miss the mark because the mark is not seen where it is. Moreover, the mirage condition, unlike wind, may give no indication of its presence, or if it does, the signs give no clue to the amount or the direction of the aberration. Only a trial shot does this, and it may be unavailing because the possible error of aim at one place on the target may not be the possible error at another place.

It is reasonable to believe, however, that the direction and amount of aberration for one particular place on the target may be indicated by a crosshair scope that has been trained on the spot in a fixed position in advance of firing. Nevertheless, Dr. Mann and associates in experiments of this nature, though they earnestly tried, failed to discover any deviation. The cause of their failure apparently was fault in the method, as both telescope and marks were situated several feet above earth. Likewise your author, with crosshairs in a spotting scope, failed for several years to discover evidence of change, this failure apparently being due to a bad parallax which, attributed to mirage, precluded isolation of the aberration element.

Lately, however, having managed to eliminate the parallax, I have had a moderate success in observing aberration close to ground, notwithstanding that the mirage season was about gone. The fact of change has been verified with both telescopic and metallic sighting devices. Also I have demonstrated with theory that crosshairs will indicate aberration, and further have demonstrated the possibility of aberration by making calculations for assumed plausible temperature differences.

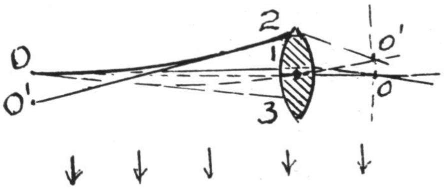

FIG. 1

Fig. 1 is used to explain how a telescope registers the deviation that is due to light refraction. 0-1 denotes the straight path of a ray from object 0 in non-refractive atmosphere to a point 1 on an objective lens. The line 0-2 denotes the curved path which a ray leaving 0 in the direction 0-1 might follow in refractive atmosphere. Refractive means that it bends light rays owing to inequality of temperatures or densities. The arrows indicate the directions in which the temperatures are required to be successively greater in order to bend a light ray 0-2 away from 0-1 in the direction shown.

As refraction changes the point of incidence from 1 to 2, this is equivalent to translating the lens upward the distance 1-2. To see the place in the object where the ray 0-2 originates, the naked eye would have to be placed at 2, and it would see 0 along the line of the tangent at 0′, as if the object had been translated downward the distance 0-0′. Thus 0 would be seen lower than it is.

Let it be supposed now that 0 is distant 100 yards from the lens and that 0-0′ equals 1 inch. The angle 0-1-0′ will equal 1 minute. At the same time, as the curved line 0-2 deviates from 0-1 in proportion to the square of the horizontal distance, then 1-2 must also equal 1 inch, and the angle between 0-1 and 0-2 equal 2 minutes. If another line 0-3 be chosen so that its tangent passes through the optic center of the lens, and the four rays 0-1, 0-2, 0′-1, and 0′-2 be traced through the lens and prolonged, their intersections with corresponding lines through the optic center will be places in the focal plane where images are formed. Neglecting for simplicity the usual erecting lenses, this is also the place where the crosshairs are situated. Thus 0 and 0′ would focus in essentially the same plane, and the separation distance be proportional to the distance between 0 and 0′, which has been assumed to equal one minute. Thus is indicated that a crosshair scope, trained and fixed on the object in advance of the change, will register the change.

But a change of object position relative to the crosshairs occurs only if rays from 0 pass obliquely through air of varying or unequal densities. For the 100 yard smallbore target as an example, the height of the sighting bull is 28 inches above the bottom record bull, this difference corresponding to 28 minutes of angle. Now suppose that the difference between temperatures at the two different levels changes 2° F. per foot of elevation. Suppose also that the objective lens is level with the center of the bottom bull, and that the isotherm, or plane of mean temperature, is parallel with a line from this lens to the center of the bottom bull. In this case the bottom bull would be seen in its right place, but the top, or sighter bull, because the rays from it are oblique to the isotherm, would be seen half a minute lower than where it is. Thus a rifle sighted for center on the top bull would shoot half a minute high when aimed and fired at the bottom bull.

The above assumed temperature difference perhaps is too large for any excepting abnormal conditions, but possibly it may exist in ordinary conditions if the firing point is shaded and the intervening range area is exposed to sun on a warm day. In fact in such a case the temperature difference which determines the refraction might be greater than the difference on which the above figure for aberration is based.

Some temperature differences observed by the author are: 4° F. between 4 feet above ground and near ground at sunset; 1° F. between 3 feet above ground and near ground in afternoon shade (ground cooler than air above); 5° F. between tree shade and sunny lawn about 50 yards distant. (These figures are for late September and October weather).

An extreme case of aberration, though it is not encountered in shooting, is observed by looking over the flame of a cigarette lighter at a distant object. Another extreme case is observed when a gasoline tank is being filled on a warm day. Here two different media, air and gasoline vapor, are involved. As the refraction index of the latter is about 1.0017, which is among the highest for vapors, objects seen through it have the underwater appearance which a target has under extreme conditions.

The refractive index for air is about 1.00029, this varying slightly with barometric pressure, color of the light, and also with temperature. The difference due to color may be neglected, and for the problem in hand a fixed barometer reading may be assumed. Thus the changes which affect the shooter depend essentially on the way in which the density of air varies with the temperature.

(Continued on Page Twelve)

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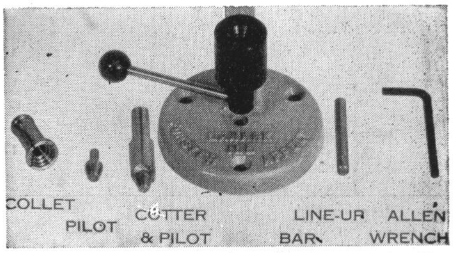

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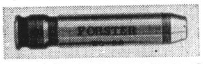

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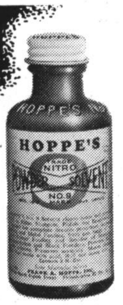

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## PRESIDENT'S CORNER

As the cold days of January are now with us and the Xmas holidays and rush are all over, I wish to extend to each and everyone of you a belated Christmas greeting and a prosperous New Year.

I see in the year before me much work to do. I will have to do exactly that to come up to the excellent work that our Past-President Bob Hart has done. I shall do my utmost to do everything I can to better the organization. A president depends on each and every one in the organization. With their help his job can be made very easy. But without their help it can falter and fall apart. There are only a few favors I will ask of you in this letter (more to come later) and they are the following:

In the winter months when we are what you would call dormant, take time to think and act. I would like each and every member to get one or more new members into the NBRSA during the coming year. Attend as many shoots as you possibly can in the coming year. You know, when registered shoots are held and only a few shooters attend, the clubs soon lose interest in doing the hard work which is carried on in putting on these shoots and the results are that the clubs soon fall by the way-side. The third and last for the present is to help every new member in every way possible. Pass on to him the ideas that have taken you so many hours to learn. Give him courage. He will need everything you have to offer.

At our meeting at Tulsa during the Nationals in 1962 we debated and re-debated on several rules changes. The results were that some members were made happy, and some unhappy. Some of my suggestions were voted down and some were accepted. After seeing and hearing the other officers objections, I was glad to give in. That is what I think all of you will do if things are only explained clearly.

The scope power change made men with less than 20/20 vision happy. Why? Because it put them back in the shooting game. It is not their fault if they are handicapped with poor eyesight. I know every shooter would do anything he could to help them have perfect eyesight. This is the only way we could think of to do it. Another reason was to only have to purchase one scope to use on all guns, therefore to help reduce the high cost of purchasing several different powers.

If time will let me, I shall try to get a column off each month in P. S. As the work has progressed I shall be glad to report it to you. I have one of the most active group of Regional Directors a president could want. As I spoke my few words at Tulsa; "Report your questions, troubles and etc. to your Regional Director. They will be glad to help you."

We are experimenting with a great many new things this coming year; guns, rules, targets, and numerous other things. A new rule book is in the making; something we have needed for a long time. This I know you will all agree. A committee will study each rule to see it is clearly defined and no loop-holes of any kind for anyone to be in the question to act upon.

To the member who brings into the NBRSA the most new members for the year 1963 I, myself, will present to him or her at the end of the year a check for $25.00. Now you don't only have something to shoot for but something to work for also.

Good health and good groups,
Al Walter

## COMMENTS OF A BENCH REST SHOOTER AFTER TAKING 61 HEAD OF BIG GAME

### By Paul C. vonRosenberg

Since 1933, when I made my first big game hunt, I have kept a record of the conditions and equipment involved during the taking of each head. Thinking these records might furnish information from which analytical observations could be made, I compiled them. Reading through these data and remembering many of the incidents vividly, I am prompted to make some comments which might be of interest and value to PS readers. These comments are also based on data from some dozen or more kills I observed made by hunting companions. First, here is a condensation of the data recorded:

**Species:** 14 whitetail deer, 16 mule deer, 7 elk, 15 antelope, 4 goat, 2 black bear, 1 caribou, 1 grizzly bear, and 1 javelina. I have also witnessed the actual taking of sheep.

**Locations:** Whitetail deer in Pennsylvania; mule deer in Colorado and British Columbia; elk in Colorado and British Columbia; antelope in Colorado, New Mexico and Wyoming; goat in British Columbia; black bear in British Columbia; caribou in Alaska; grizzly bear in Alaska; and javelina in Arizona.

**Calibers:** .22/250 on whitetail deer; 6mm International (Durham version) on antelope; .244 Remington Improved on mule deer and antelope; .257 Jet on antelope and javelina; .257 Roberts on whitetail and mule deer and on antelope; 6.5mm/.257 Improved on antelope and mule deer; .270 Winchester on mule and whitetail deer and elk; .270 Newton on whitetail deer, antelope, caribou and grizzly bear; .276 BJ Express on goat and elk; 8mm Mauser on elk and mule deer; 8mm. '06 Improved on mule deer, goat and antelope; .334 Gipson Magnum on mule deer, black bear, elk and goat; and 9X57mm Rimmed on mule deer.

**Bullets:** .22 cal. 55 gr. Sisk Express; 6mm 90 gr. Barnes SP, 100 gr. Hornady Spire and 90 gr. Remington Bronze Point; .2 cal. 70 gr. Hornady Spire HP, 100 gr. Barnes SP, 100 gr. Winchester Silvertip, 100 gr. Sierra SP and 100 gr. Nosler; 6.5mm 130 gr. Barnes SP; .270 cal. 130 gr. Winchester Copper Point Expanding, 145 gr. Western Tool & Copper HP; 140, 150 and 160 gr. Barnes Spitzer SP; 7mm 140 gr. Nosler and 180 Barnes SP; 8mm 236 gr. Winchester RNSP and 200 gr. Barnes Spitzer SP; 33 cal. 200 and 250 gr. Spitzer and 300 gr. Semi-Pt Barnes SP; and 9mm 250 gr. Barnes Spitzer SP. Of these 11 were factory and 50 handloads.

**Rifles:** Mannlicher 88, Winchester 70, Mauser 98, Remington 721, Enfield P17, Arisaka, German OU Double, Mauser G 33-40, Mexican Mauser 98, and FN Mauser. Some of these were extensively remodeled and were fitted with custom stocks by Brownell, Fisher and Frost.

**Sights:** One open metallic. Scopes: Unertl 4x and 6x; Weaver 2½x, 4x, 5x and 6x; two Bear Cub 6x; and Lyman 8x. Mounts were Peterson, Redfield, Weaver, Stith, two Lehman, Turner, Carmen, Tilden, and two Buehler.

**Range:** Records are not exact or complete; 75 to 500 yards plus. Most shots 125 to 325 yards. Average distance about 225 yards.

**Animal Motion:** 5 walking, 2 running and 54 standing, lying down or virtually still. Some were moving immediately before the shot.

**One Shot Kills:** 52 out of 61. No lost animals. Approximately 70% of the animals moved off after the hit, 8 of them running hard and had to be trailed up.

Now, after this resume of conditions and equipment, are my comments:

**Stalking:** Good hunting techniques pay off just as much as good shooting. Many times a canny stalk can obviate the necessity for a very long range shot or even the requirement that the rifle, cartridge and load be heavy, large and extreme velocity for long range shooting. An unsuspecting animal in clear sight 200 or so yards away is an easy target, and there is no excuse for the hunter-rifleman not to place his bullet in a vital spot with almost any modern bolt action cartridge fired from a scope sighted rifle.

**Shooting Technique:** Bench rest shooting can be good practice for good shooting technique in the field. If the rifleman-hunter will remember the fundamentals of holding, sighting and squeezing he can do well in the field even though the time to get off the shot is short and the shooting position improvised. An improvised rest when sitting, prone or semi-prone is a great help on shots 200 yards and over. The accurate placement of the shot resulting from a good solid position can easily make up for 1000 pounds of energy or 100 grains of bullet weight.

**Practice:** Practice and familiarity with the rifle and load immediately before the hunt is invaluable even though the hunter is an old hand and has done a lot of bench shooting. Firing 20 or more shots, some at the bench, some sitting and some prone will often remind the shooter of limitations, both physical and equipment, and show up some detail thought to be of little or no consequence but actually needing attention.

**Accuracy:** A hunting rifle and load when shot at 100 yards that will place 12 shots, fired in 3 shot strings at extended intervals, in a 3 inch circle is accurate enough not to handicap most hunter-riflemen. The gun that will stay in a 2 inch circle, when so fired, will tax the ability of the best shots in the field and, when combined with flat trajectory and good holding, is an effective long range proposition.

**Scopes:** A good solidly mounted scope is a dependable and preferred sight for most big game hunting. Except for the very poorest weather conditions, a rifle with fixed scope and no iron sights is no handicap. I doubt that magnification over 3x is of much additional value in the field but personally prefer 4x. Higher than 3x may be desirable in looking at game to determine trophy characteristics and is also advantageous at the target in developing an accurate load and proficiency from close sighting, holding and squeezing.

**Bullet Performance:** When dressing out game, tracing the wound channel and recovering the bullet is enlightening. Enough data through this method can give some categorical, even though not exact, idea of what to expect from certain types, diameters and makes of bullets at various velocities. Game the size of deer, antelope, goat and sheep can be regularly killed from reasonably well placed shots by small caliber rifles with suitable game bullets.

**Velocity:** For Western hunting a load developing 3000 fs velocity will shoot flat enough for any long range work. If the hunter is a good shot and the rifle accurate 3000 fs is preferable to any lower velocity and consequently less flat trajectory. Velocities over 3000 fs are somewhat advantageous because of flattening of trajectories, but may be obtained by substantially increased recoil or light weight varmint type bullets. If a load exceeds 3300 fs some characteristics of it or the rifle that can effectively shoot it will probably be undesirable.

**Killing Power:** The most important consideration for a clean, humane, one-shot kill is placing the bullet in a vital spot, preferably in the chest cavity from the side, front or front-quartering aiming point. When this is done, game the size of deer, antelope, goat and sheep are dispatched by 6mm and .25 cal. bullets 85 to 100 grs. weight starting out at 3000 fs or slightly more just about as well as anything more powerful. Larger species are taken more cleanly by loads developing in the neighborhood of 3000 foot pounds initial energy. Loads that stress extremes of velocity, caliber or bullet weight are frequently and vociferously extolled by their protagonists. These radical opinions are not likely to be based on much experience with a variety of calibers, loads, bullets, etc. The better hunting calibers and loads are usually a good compromise on bullet weight, velocity and caliber.

**How Small A Gun:** The .222 Remington Magnum is usually exceptionally accurate, shoots flat and has little enough recoil to permit the shooter to become a good shot with it. The combination of bullet weight, energy and diameter, however, is in my opinion insufficient to recommend it even though the cautious, expert hunter-shooter could probably use one with a high degree of success on deer, antelope, etc. My experience with .22 cal. rifles on big game is quite limited and I do not feel authoritative. Even after seeing some excellent deer kills with the .22/250 and .220 Swift I would be reluctant to do much hunting with either. Perhaps the .22s shooting 70 grain or heavier bullets at 3200 fs or more are big game calibers. Categorically a 6mm with an 85 gr. bullet at 2900 fs or more is equally so. The main reason for selecting a gun more powerful than a .250/3000 for trophy hunting deer, goat and sheep is because on an extended trip an offer may be presented at larger game—grizzly, moose, etc.—when hunting these species.

**How Large A Gun:** Large or medium caliber rifles frequently in their modern versions shoot heavy or medium heavy bullets at high enough velocities to have flat trajectories. They tend to be less accurate, however, than rifles adequate for deer, antelope, goat and sheep. The lesser accuracy is principally attributed to recoil. Recoil adversely affects accuracy in two ways: first, the rifle mechanism is inherently less accurate because of the magnitude of the stresses applied to the metal of the barrel and action, and the transfer of these stresses to the stock; second, the movement of the rifle under recoil affects the shooter physically and psychologically. The strains set up by the recoil stresses tend to become less uniform as their magnitude increases. This lack of uniformity means lessening inherent rifle accuracy. Even though recoil does not hurt the shooter, it "bothers" him. This "bothering" occurs long before the threshold of punishment, prevents him from exact uniformity when his hold, sight and squeeze could be perfect. As an example, the .375 Magnum is generous in bullet energy, penetration, size of bullet channel and shoots quite flat. Inherent accuracy is frequently good enough to stay in the 3 inch circle (12 shots in four 3 shot strings) but I have known only a few shooters who are man enough to shoot the several hundred rounds a year necessary to work up an accurate load and be expert shooting the .375. Generally the acceptable gun weight of a .375 is enough to be tiring where much rough mountain going is encountered. I believe, therefore, that a .375 is not a good choice as a general big game rifle, but an excellent choice for specialized uses where the great power of the arm is important and offsets the other drawbacks. I now own a .375. It has an effective muzzle brake. In due time I expect to shoot a Kodiak bear with it. If I owned a .30-06 and contemplated a trip for Kodiak bear I would think the .30-06 marginally satisfactory. A .375 would be a desirable but not absolutely necessary alternative.

**The Mountain Rifle:** Most trophy hunts for sheep, goat or mule deer take one into the high country. Generally the combination of altitude, climbing and rock work tax the physical ability of the white-collar hunter. His trip to Alaska, Canada, Montana or Idaho costs quite a bit per day, and it behooves him to be able to walk and climb most days when the weather permits. His rifle is the heaviest and unhandiest article that must be carried. The lightest, shortest, scope sighted, accurate rifle available is a burden and hangs heavy at the end of a mountain-climbing day. This means the mountain rifle should be light and short. If it is to be light and short, as well as accurate, it should be chambered for a moderate cartridge. My prescription is one of the lighter and shorter actions with a 21 or 22 inch barrel, weighing with 4x scope not over 7 lbs. I would choose from among the .25, 6.5mm, .270 or 7mm calibers shooting a bullet of from 115 to 140 grs. at around 3000 fs velocity. This same rifle will also be a good choice for antelope and general deer hunting. Mine is a .257 Jet (.243 Winchester opened up to .25 cal., body length unchanged, shoulder sharpened and neck lengthened) on a Mexican Mauser, 21 inch Douglas barrel, Brownell French walnut, slim, classic lined stock with hidden magazine, Canjar trigger, Weaver K4 in Buehler rings and Durham bases. Weight 6½ lbs. The .257 Jet has slightly less case capacity than the .257 Roberts and gives virtually identical ballistics. It is somewhat shorter and permits loading heavier bullets well out, but offers no practical advantage over the .257 Roberts. My favorite load is the 115 gr. pointed Nosler ahead of 45.8 grs. of 4831 in Winchester brass with W-W 120 primers. Velocity in my rifle is 3010 fs.

**The All-Around Western Rifle:** The all-around western rifle for general big game hunting where species may include moose, elk, or grizzly bear, in addition to sheep, goat and deer should be a medium weight, medium caliber sporter on a standard bolt action with a 22 or 23 inch barrel, weighing with scope about 8½ lbs. Scope may be 4x, 6x or variable power. I would recommend the choice from among the 6.5mm, .270, 7mm or .30 calibers shooting a bullet of from 130 to 180 grs. at around 3000 fs velocity. Muzzle energy should preferably be 3000 foot pounds or more. When the all-around rifle is used on game the size of elk a controlled expansion bullet is preferable to insure penetration of bone and muscle when they cover the chest cavity. If conventional bullets are used on larger animals in the interest of good penetration, they should be among the heavier weights offered for the caliber, even though some sacrifice in flat trajectory is entailed. My present rifle that fills this prescription is a 7mm Magnum similar to the Remington version (mine was made from .264 Winchester brass before Remington introduced their 7mm). My 7mm, cut with a Durham designed reamer, has shoulder sharpened and neck lengthened and is on a G 33-40 Mauser, 23 inch Douglas barrel; Brownell Claro walnut, medium, monte carlo stock with hidden magazine; Canjar trigger; Bear Cub 6x in Tilden mounts. Weight 8½ lbs. My favorite load is the 160 gr. Nosler, 173 gr. RWS H-Mantel, or 180 gr. Barnes bullet ahead of 66.7 grs. 4831 in Winchester brass with W-W 120 primers. Velocity of the 160 gr. bullet in my rifle is 3040 fs. Heavier powder charges of 4831 may be used giving muzzle energies up to 3600 foot pounds but such loads are less accurate and pleasant to shoot (from the bench) than the 66.7 gr. charge.

**The Heavy Big Game Rifle:** To fill out the battery, a heavy game rifle is first choice for Alaskan moose or brown bear, or equivalent African species. This persuasion can be on a standard or magnum bolt action, the M71 Winchester lever action, or a double barreled rifle. I prefer the rifle of a handy overall length, not greater than that provided by a 22 or 23 inch barrel on a bolt action. Weight should be with scope not to exceed 9½ lbs. Without scope weight could be as low as 8 lbs. if recoil tolerance permits. A muzzle brake can reduce recoil as much as 40% but is an ear blaster. I prefer one on the heavy rifle, using ear plugs at the target. Scope may be 2½x, 3x or 4x. Mount should be quick detachable or swing-over with emphasis on secure fastening. Auxiliary iron sights should be fitted. Caliber should be .33 or larger,

(Continued on Page Ten)

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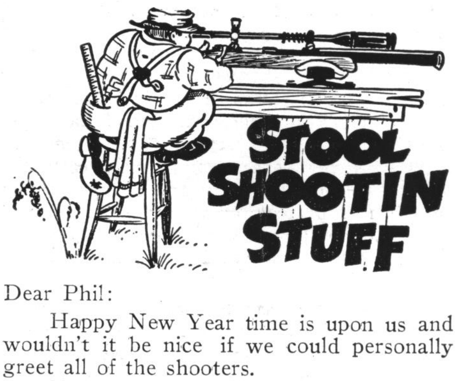
## Comments Of A Bench Rest Shooter

(Continued from Page Nine)

shooting a bullet of around 250 grs. or more with a muzzle energy preferably 3500 foot pounds or more. Heavy jacketed or controlled expansion bullets should be used. My heavy rifle was a .334 Gipson Magnum now rebarreled to .375 Magnum Improved (Weatherby) and is on a P17 Enfield action, interior lengthened to handle 3¾ inch overall loaded rounds. It has a 23 inch Douglas barrel, 1½ inch of which is a Buhmiller design muzzle brake. Stock is by Brownell, exact same dimensions as the one on my 7mm Magnum. Scope is Weaver KV in Turner QD mount. A Mashburn trigger, Redfield sour-dough ramp front and folding leaf shallow V rear complete the detail. Weight is 8½ lbs. My current load is the 300 gr. Nosler or Barnes heavy jacket ahead of 90.0 grs. of 4350 in Winchester brass with W-W 120 primers. Velocity is 2730 fs. This gun is no toy, but I can manage to shoot 20 or 30 rounds at a sitting at the bench without losing too much composure.

My guns are not described as the epitome of the modern hunting rifle since there are, no doubt, many other specifications which will fill the particular requirements of shooters whose experiences do not exactly parallel mine. I would like to have their experiences and comments added to mine.

Good hunting, shooters!



Dear Phil:

Happy New Year time is upon us and wouldn't it be nice if we could personally greet all of the shooters.

Now that we are just breaking out of the deep freeze, we get a chance to think back to the sunny days when the smiling faces and happy voices were engaged in some shooting activity. The colorful cards which are exchanged at the Holiday season is good evidence that there is a deep and lasting feeling of friendship between those who burn powder in one form or another.

The statistics which are breaking out indicating the great number of people who last year bought big game licenses impress me very much. The millions who own guns and are going out into the woods for game of one type or another gives us a clear picture of how important the gun is in creating happiness but I am afraid we shall always be faced with the problem created by the would-be do-gooders who would rule out firearms from the hands of all but the military or the police. They are so naive that they cannot recognize that the criminal will never have much difficulty obtaining firearms. In 1963, the problem will continue and we therefore must with more zest than ever endeavor to guide legislation, teach youth the safety and pleasure of firearms and present a picture of responsibility to our communities whether they be made up of people for or against guns.

Going back to the comments about the deep freeze brings to mind something that perhaps some of our readers have not considered. A gentle snowfall can often be a very good period for testing a rifle. Notice that I accented the word gentle because, of course, the whirling flakes of a blizzard cannot guide us at all as far as wind conditions are concerned. The flakes as they filter down in a mild and not too thick snowstorm very clearly indicate what the wind conditions are and there is little excuse for touching one off under a reverse of wind conditions. It is nice to do the shooting from an enclosure but if you take advantage of such enclosure, make sure there is not enough heat escaping from your firing port to create a mirage.

I always have planned a backlog of things to do during the winter months when we cannot get out and enjoy shooting but for a very few days. Some of these missions are accomplished but as I grow older I find that there are always so many things planned that some things have to go by the board. I ask you if that isn't better than being at a loss for things to do. Many of the days or evenings in the winter period are used for bullet making and I presume that such is the case with many of our shooters who make their own projectiles.

The big ad for the Mity Mite bullet swager was a hard thing to miss but for that matter, who would want to miss it. It is just evidence that people are thinking all of the time about new ways of doing things, and it is too early to tell whether this product will have a long life or a short one. I read with considerable interest your comments on it and shall look forward to seeing more information as well as the product itself.

I am kind of a skeptical guy and can't convince myself that it will "spit out bullets like a machine gun." I've been around long enough to know that West Coasters must necessarily be influenced by the movie industry and therefore our good shooter friends undoubtedly come naturally by these "stupendous and colossal" adjectives. The manufacturers of this new tool are not new to the shooting game and they really recognize that speed in making bullets can only be carried to a limited extent. A rate of production more like a good smooth working Krag firing in a slow fire match would be about right if one is going to take advantage of "feel" as well as visual inspection. When I first saw the announcement of the press, I worried a little because I feared it was not going to be practical to use it in the vertical position. I have tried a half dozen different presses in all sorts of angles and positions and I have always come back to the vertical with the use of the lever stroke about 45 degree angle from the bench space. Of course, I use a catcher which picks up the units from the die mouth whether I am swaging cores, seating cores, or forming the bullets and, therefore, it is necessary only to feed the units into the mouth of the die. Experience develops timing and is also a good teacher as we have all learned when we left our fingers too close to that moving ram or punch and found that a pinched finger could very easily lead to a long string of profanity. Of course, there was nobody to blame usually but one's own self as it was his other hand that was operating the lever but the inclination to cuss comes just the same.

I guess I have made more good bullets with my RCBS presses than most fellows have ever seen. I bewailed the demise of the Type B RCBS but now my RCBS Jr. must be well past the half million mark for strokes. I often put through 10,000 a day on it and all it asks for is constant lubrication and an occasional cleaning. I made a little adapter to modify the angle of my handle so that it is convenient to work from a sitting position at a low bench level and I long ago adapted a stroke counter for convenience in keeping track of my units. As you folks undoubtedly recognize, the cost of a frame alone for an RCBS Jr. does not tax the pocketbook too badly.

There is another new press that I have tested which is easy on the pocketbook, too. This is the new little Pacific Standard which I think is a very convenient and satisfactory press. It is made out of aluminum which is quality cast and quality machined throughout and the light weight and convenient take down features make it very easy to transfer from place to place. It has adequate leverage and operating speed for the biggest of jobs, whether they be case sizing or large caliber bullet making. I found the base on this new little press to be one of the advantageous features that no one seems to speak about. It, of course, conveniently bolts onto a bench but it can readily be clamped in place with C clamps, too. If you are one of these guys who wants to use it at odd angles, just note how easy that base will become adaptable to a pair of vice jaws. There is finger clearance and versatility and I'll let you in on a little secret. When you have dies of good quality which are true and carefully polished in the cavities, and you use a good lubricant properly, almost any press on the market has four times the leverage that is required.

Given the dies in the good conditions referred to above, if you are having leverage problems, you had better look into the situation because something is wrong. Bear in mind that I am not recommending that presses be made with less power because I am well aware that reserve power is of great advantage under certain conditions but like the reserve power in the modern car, it should be used with discretion. I cannot emphasize too strongly the importance of holding up on that power stroke when you find that more than ordinary resistance is being met. You can break the best of dies but long before that, you will have created a bullet that never can be an accurate one. For instance, it doesn't require too much excessive pressure when seating a lead core and jacket to start the lead bleeding by the punch end. No lead, and I repeat no, can bleed by the punch end at the core seating stage and a well balanced bullet result. A punch can fit so tightly to the inner part of the jacket that no lead will bleed by but the jacket will stretch and in some instances, fracture at the lead line or slightly below it. Of course, all the effort put into the bullet up to that stage has been wasted and the nearest waste container is none too close. Before the fracture stage is reached, a stretching period occurs and these are sometimes hard to detect; however, they will make bad bullets which can often be bad enough to blow up in flight.

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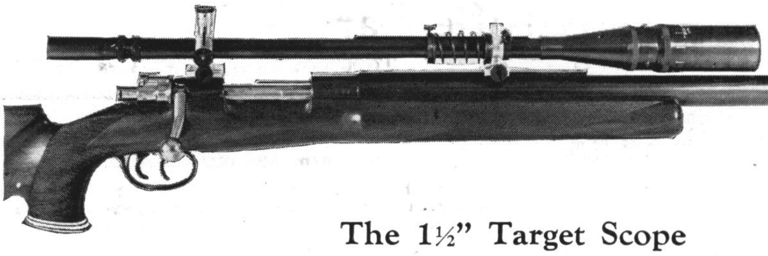

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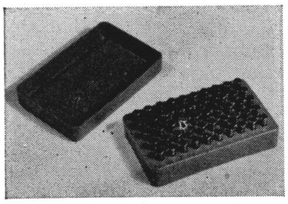

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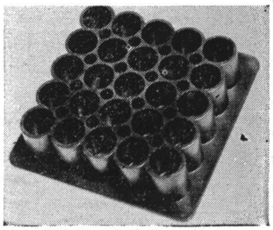

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We all rely on our eyes a good deal to maintain quality control in our bullet making or reloading operations but I have frequently said, and I repeat it here, that an alert blind person because of his greatly developed sense of touch and sound could make more perfect bullets out of a lot of a thousand components than many of us do with 20/20 vision which we rely upon almost solely.

I liked the article which our competitive friend, Warren Page, wrote in his magazine. It was nice of him to give Crawf Hollidge a little boost on his bullets but I liked it for other reasons, too. He brought us up to date on some things and that is a very good service, not only for we who have been shooting for a long time but those newer fellows who find much wheat and chaff around but have difficulty in separating the two. You will note that I started this paragraph by referring to our competitive friend and no matter how many heads of big game he may shoot, I'll always think of him as a shooting competitor who with comparatively little practice from one season's end to the other, comes to the

(Continued on Page Twelve)

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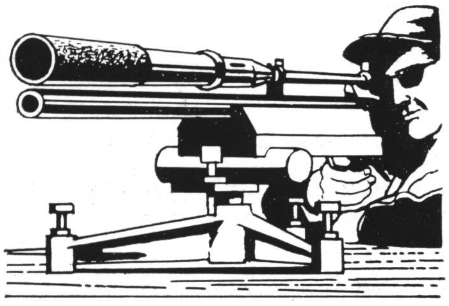

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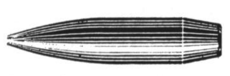

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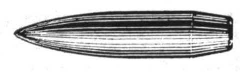

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(Continued from Page Eleven)

matches and raises hell with the standing of others who attend dozens of matches to his one and perhaps have been to the shoot two days before it opened testing the wind and mirage conditions and cataloguing such peculiarities as that particular range may have.

In our own little magazine I thought the column describing some of the equipment and techniques of Lt. Kendall was of considerable interest. Granted that there is a lot of difference between small bore shooting and our game, nevertheless we can learn from it just as we teach it some of our tricks. Lt. Kendall is a very young man, yet in his life there has been a lot of shooting experience and he will find like many of us have that the ideas he thought were so essential at one stage may not be quite so momentous at a later one. I thought his approach to the scope problem was pretty good as in later years I have come to believe that many of us put too much accent on magnification. We want to see the target clearly, yet we want also to see the mirage conditions. I think that perhaps is one reason why I am growing more fond of my B & L. It's not much of a problem to turn it to a lower magnification and after I have once detected the mirage conditions, it doesn't seem to be difficult to keep track of them with slightly less power and I heartily agree that anything that adversely affects concentration and causes a feeling of uneasiness is detrimental to accuracy. Notice that he said that without a good rifle, one has a poor chance in any competition. This is certainly true where the experience level and high professional ability of the other competitors stands out. I know that money in itself won't assure one's receiving a good rifle. There isn't a shooter on the line with any experience who hasn't over the period that he has had his rifle, little by little, improved it. We all like to buy new ones from time to time but when we get them on the benches, we almost always find that the comparison between the newest one and the oldest one proves that the new one will be hard pressed and succumb to some change before it is demonstrating its capabilities.

I receive many letters asking for advice on procuring a new rifle from boys who are thinking of entering the benchrest game and I take pleasure in giving them all the help I can. A point which I always stress is that the new shooter should start with as good a gun as he is able to afford so that he can get the maximum pleasure from and be competitive in the game. Sometimes it may be a used gun as I certainly believe that there is a good deal more life to a gun than most of us think, and if a chap is new to the game, he wants to do a lot of shooting both by himself and in competition. On the other hand, if an experienced shooter sells a gun to a newcomer and that gun is not good enough to give the newcomer a fair break, the seller is doing a decided disservice to the shooting game. In thinking back over my experiences, I must recall that I have seen many good guns sold to shooters who treated them so carelessly and in some cases abused them that the guns quickly lost their gilt edge accuracy and we are always faced with the shooter with a good gun who won't take enough pains with his loading techniques to get the best out of his rifle.

Cordially yours,

Ernest Stuhlschuter

**On The Measurement**

(Continued from Page Seven)

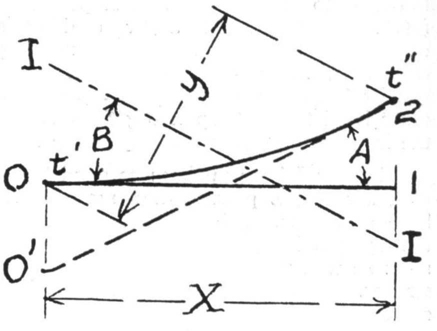

FIG. 2

For this index, and in air whose temperature changes uniformly with respect to the isotherm plane, the change of angle of a light ray coming from an object 0, Fig. 2, and refracted away from that plane over a distance X is given by the equation

(1) $A = .2610\ kX \cos B$

in which A is in minutes of angle, and X is the horizontal distance between 0 and 1 in hundreds of yards. I-I in Fig. 2 denotes the plane of the isotherm, or plane of equal temperatures, which must pass between 0 and 1 if temperatures t' and t" are different. Cos B refers to the angle B which the initial direction of the light ray from 0 makes with I-I, k equals the temperature difference t'-t" divided by the distance y in feet, y being measured between lines drawn through 0 and 2 parallel to I-I. For practical purposes, as the distance between 1 and 2 is small, temperature at 1 may be used for temperature at 2. Finally 2-0', the line of the tangent, is the line on which 0 is seen at 0'.

This figure assumes that t' is greater than t", i. e. that the warmer air is underneath the cooler. If I-I sloped in the opposite direction so that the ray from 0 originated in the cooler air, or in the reverse case in which the cooler air were underneath, the ray would curve in direction opposite to that shown.

The figure is drawn for an isotherm plane which would be parallel with the surface of the earth if the angle B were zero. In practice, for such a case, the angle B is always so small that cos B is essentially equal to 1.

However, the plane containing I-I may lie at any other angle of the clock. It may be perpendicular to earth and disposed at any angle up to 90°. In event it is then 90° from the plane of fire, though t' and t" differ greatly, cos B will equal zero and the aberration be nil. Thus Eq. (1) refers to aberration in any angle at which I-I happens to be disposed. The plane in which the aberration is measured is always perpendicular to the isotherm plane, and aberration is present whenever the sight line is oblique to that plane.

Eq. (1) is nearly correct, but only so for small values of the angle B and a uniform temperature gradient. Its principal errors then are that the barometer reading is assumed to be the same at the different temperature locations, and also that the numerical constant is based on a fixed average temperature, which is 72° F. For large values of B the errors are somewhat larger, but in this case the aberration itself tends to approach zero.

For small values of the angle B this equation indicates an aberration of about one-fourth minute of angle per 100 yards for each Fahr. degree of temperature differ-

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ence. This difference between the firing point and the mark might be 4°, for example. Two thermometers would indicate this, but tell nothing about the angle or direction of the plane in which the isotherm, or plane of equal temperature, lies. It might be either horizontal or vertical, or inclined at some other angle of the clock. Thus it is obvious that an instrument indication, rather than a formula, is the only practical manner of predicting which way and how far off the shot will go.

As to determining this with instruments, it presently appears that the crosshair telescope is the best device. The recent success which the author has had with it was only fair, but the indicated aberrations were small because the season of heat and heavy mirage was almost gone when the undertaking was fairly underway. At least, however, the basic requirements were discovered.

First of all the scope must be immovably fixed in place, for it is truly amazing what an infinitesimal position change will do to the sight line. A scope set up indoors with legs of the stand on a solid support was found to hold on the chosen mark for hours; but when a few sheets of paper were interposed between one leg of the stand and the otherwise solid support the crosshairs moved off the mark at the rate of about one minute per hour for two or three hours.

This experiment proved that a yielding support yields with a slowness that almost defies belief. In another experiment this was borne out by a similar slowness of change that was observed when an ordinary rifle scope was laid in the forks of a stand and buckled down with a strap. One projecting end of the scope being heavier than the other, this tended to stretch the strap, with result of a slow crosshair creep that amounted to minutes over a long time. In another experiment metallic sights were mounted on a three foot length of slender drill rod. If the assembly was laid in the forks with its balance point symmetrical with them, the sight line held to the mark; but if the rod was out of symmetry with the forks the unequal free ends sagged at different slow rates, this moving the sight line off the mark. A similar slow creep was observed if the scope stand rested on the trunk or hood of an automobile.

All this goes to show that a very solid support is needed if aberrations are to be discovered with fixed sighting devices. Obviously the concrete slab of a benchrest constitutes a solid support. By experiment it was learned also that earth itself is a solid enough support, provided that the scope legs are pressed down in the sod until they reach dirt.

It was discovered also that, for accurate observation, only a scope of ample magnification and free of parallax would do. A metallic sight arrangement with 37″ between apertures failed because it would show only direction and not the amount of

(Continued on Page Fourteen)

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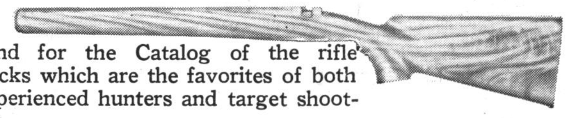

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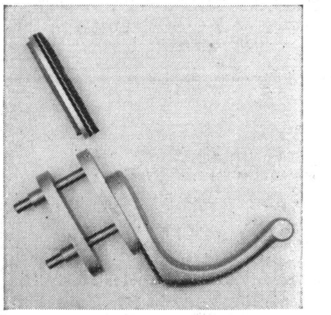

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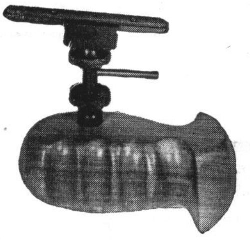

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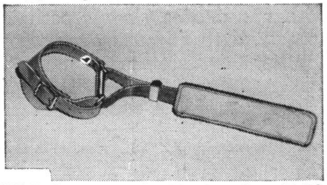

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## On The Measurement

(Continued from Page Thirteen)

deviation. Moreover, the metallic sight devices, because of length and need of symmetry, occupied too much space on the smallbore firing point to be of practical use in the course of firing. Thus for determining sight line aberrations a scope is a necessity.

In some of the available spotting scopes it may be fairly easy to install crosshairs at very little more than focal distance ahead of the eye-piece. For my B&L 65 mm scope it was necessary only to pluck strands from a worn nylon necktie and fasten them with shellac across the open end of the hard rubber tube which is an integral part of the interchangeable eye-piece; though it was long before I learned that parallax could be eliminated by rotating the eye-piece itself a fraction of a turn on its thread.

As result of experiment it seems that a crosshair scope of about 20 power and rigidly trained on a spot near the record group would help the benchrest shooter. For the smallbore shooter the problem is less simple; but if the details were satisfactorily worked out, the universal application of them might help to save the smallbore game from extinction, the fate toward which it presently trends. To begin with it is almost a necessity that the scope employed be the one which is also used for spotting bullet holes. Also the difficulty of attaining the requisite rigidity would require unstinted care in pressing the legs firmly into earth. Further there is the difficulty that the smallbore shooter is required to fire at different places on the target. Whether the scope should be trained on the sighter bull or on a lower record bull is something that might have to be determined by experiment. Because the sight line would be nearer to earth and its angle flatter I incline to belief that one of the lower bulls would be the better choice on a level range.

Last summer I had an exasperating experience in which conditions changed on the bottom bull but not on the sighter, and the range was only 50 yards. Though I was going back to the sighter after each point dropped, observing no change there, and nevertheless had clicked for the last shot, still the last three shots went into one hole at 12 o'clock in the 9-ring.

This happened at Camp Perry in early morning. I believe that the cause was a rising thermal cell somewhere back of the target, drawing a current of cold air at the ground at sufficient distance that I did not shoot through it when firing on the sighter bull. The shooter on my right finished just before the upset occurred and went clean.

Here is another exasperating but interesting and unusual case which has twice come under my observation. Just back of my practice firing point and in the 4 o'clock direction was a large range house; the other condition was a variable prevailing wind which came from over the roof of the range house. In both instances of such a wind shots deviated so high and low that, if the fired targets were rotated through 90° for inspection, the bullet holes appeared to be strung out between 10 and 4 o'clock, just as if the shooting had been done in a strong cross wind whose variations had been ignored.

My explanation to this: To get over the roof the wind rose in approach to it, and on the lee side dropped back to earth somewhere between firing point and target at considerable distance out. Its temperature may have been changed several degrees during the passage over the roof. Its direction was oblique both to earth and the plane of fire. The resulting light refraction

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varied with the strength of the wind and caused the shots to string out between 2 and 8 o'clock almost from 9-ring to 9-ring. In both instances perhaps a crosshair scope trained on any one of the bulls might have saved the score.

I regret that more data was not obtained with the crosshair scope. The experimenting was started soon enough; but, by the time that a suitable familiarity with the problem had been gained, the melancholy days were almost here. Moreover, I must admit that both calculation and observation show less of aberration than I had learned to expect. However, the fact that the observed aberrations were small led me to a different and perhaps important conclusion about this shooting business.

This conclusion is that small changes of wind and mirage conditions affect different shooters in different ways, and that a good doper is not necessarily a good winner. Suppose that one shooter can hold and squeeze for a 40x possible under ideal conditions. On the 100 yard target he can stand half a minute of angle condition change in any direction of the clock and still fire a possible. Another who can fire only 400-30x under ideal conditions may come off with a 399. His 10 shots which, under ideal conditions, would not touch the x-ring, may be scattered all over the remaining 10-ring area. Thus only a small fraction of a minute of angle of condition change may put a skinny one out for a 9. The lesson to be learned is that close holding and careful squeezing may pay off better than good doping.

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I found the quality of the entire book measured up to the excellence of Powley's "Shooting In The Wind" paper. The first 254 pages of the 565 page book are devoted to discussions of shooting subjects, all of which present the view-point of two or more persons of wide experience. The discussion of "killing Power" is recommended reading for any hunter, since it presents the views of several people who have killed and/or observed the killing of large numbers of big game animals. Pressure, including the unpredictable detonation of reduced charges of the slow burning powders, headspace, bore capacity and loading dies are subjects discussed.

The latter half of the book is devoted to description, comment and loading data on wild cat cartridges, along with standard factory cartridges. The wildcats are in the majority and a great many of them I'd never heard of before. A wildcatter himself, and an honest one, Ackley is probably the best qualified person in the country to handle this subject.

A bonus with the book is a set of five exterior ballistics charts, with methods of calculation and instructions, prepared by du Pont ballistics engineers Wallace H. Cox and Edgar Beugless, which will be of interest and worth to every serious rifleman.

I consider this new book to be a worthwhile and informative addition to any shooter's library. It may be available from some shooting supply dealers or it can be obtained directly from Parker O. Ackley, 2235 Arbor Lane, Salt Lake City, Utah. The retail price is $5.95.

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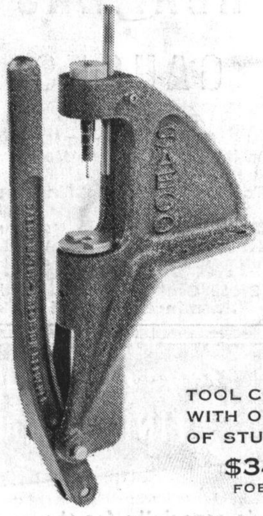

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